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THE DISPOSAL OF COAL ASH AT TORONTO'S OUTER HARBOUR

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May 1991

William Munson works as Environmental Coordinator with the Water Pollution Control Division of the Metropolitan Works Department. This paper is a slightly amended version of a major paper presented in partial fulfilment of the degree of Master of Environmental Studies at the Faculty of Environmental Studies, York University.

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TABLE OF CONTENTS

	page
Foreword	
Introduction	1
Land Creation at Toronto's Outer Harbour	7
The Filling of Ashbridge's Bay	7
Filling Along the Shoreline, 1949-1964	8
Creating the Outer Harbour Headland, 1965-1977	16
Conclusions	26
List of Sources	33
Acknowledgements	38

LIST OF MAPS

	page following
Map 1: Land Creation around Toronto Bay	2
Map 2: Toronto Harbour, 1841	8
Map 3: Planned Port Industrial District, 1912	8
Map 4: The Port Industrial District, 1950	8
Map 5: The Port Industrial District, 1954	12
Map 6: Headland Endikement Project	26

FOREWORD

The specific subject of this paper is the disposal of coal ash at Toronto's outer harbour; the central chapter is a thorough chronology of the practice over a twenty-year period from the early 1950s to the early 1970s. The broader topic, however, is the use of urban waterfronts as dumping grounds for the waste products of city building, and introductory and concluding chapters therefore place the practice in a wider context. The considerable attention being paid to the urban environment in general, and the urban waterfront environment in particular, suggests that the topic is of considerable current interest.

The rationale for pursuing and presenting this original research is three-fold. First, from the broadest perspective, the findings presented in this paper are relevant to cities around the world; the use of waste materials such as coal ash in the creation of urban land is a world-wide phenomenon, and the potential environmental implications of this situation must be recognised. Second, from a narrower perspective of concern with urban planning and development in Toronto, the findings demonstrate how large institutional interests have helped to shape the Toronto waterfront by allowing it to be used as a disposal site for various types of urban waste. Third, from a still narrower perspective of concern with environmental quality in the area around Toronto's outer harbour, the findings should help to identify areas of land where remedial measures will be required if environmental health is to be safeguarded. There is general recognition that a thorough programme of soil testing and remediation will have to precede redevelopment in the area of the outer harbour.

Coal ash is liable to contain a number of heavy metals and toxic chemicals that are considered hazardous to human and environmental health. If coal ash is used in land creation, these contaminants may be transported by way of natural leaching processes into the adjacent lake water where they may enter the food chain. Left unremediated, especially high concentrations onsite could be phyto-toxic or even injurious to human health. Although this situation is unlikely, the possibility must be carefully addressed in planning for redevelopment and use of the area where coal ash was deposited in large quantities. Knowledge of the specific contaminants liable to be found at particular sites allows soil consultants to focus their testing on those contaminants, thereby improving the accuracy of tests and at the same time reducing costs.

INTRODUCTION

The creation of new urban land by filling portions of water bodies is common practice around the world. Most often it is undertaken to provide disposal sites for waste materials (Goudie, 1986). The waste materials used in urban land creation are the "refuse of an expanding city" (City of New York, 1951), and fall into four general categories—clean fill, domestic garbage, dredged material and industrial waste (Hudson, 1979).

In Toronto, the filling of portions of Lake Ontario and its inlets to create new land has been an important part of the city-building process for 150 years (Environment and Health Work Group, 1988), as is shown on Map 1. The main purpose of the larger land-creation projects undertaken in Toronto before the second world war appears to have been to create developable land. Land was required to accommodate the needs of the railway companies that had come to dominate the waterfront by the mid-1880s (Greenberg and Sicheri, 1990), and later to accommodate the new Port Industrial District immediately to the east of Toronto Bay (Moir, 1988).

The largest local land-creation project of recent decades has been the construction of the outer harbour headland, which is now a peninsula extending some five kilometres into Lake Ontario from the foot of Leslie Street at the eastern end of the Port Industrial District. The headland and adjacent areas of the shoreline were created by the placement of fill materials since 1949, initially for the purpose of accommodating a southward expansion of the port district. That practice has come to be recognised not only as a method of creating land, but also as a means of providing convenient and inexpensive disposal sites for large quantities of waste material from demolitions and excavations in the city. Construction of the headland has been described as a "massive recycling project" for excavated and dredged materials (Gemmil, 1978).

A study released in 1984 by the Municipality of Metropolitan Toronto recognised that the development industry's desire for inexpensive disposal sites for excavated material has been the main reason for land creation at the headland and elsewhere (Metropolitan Toronto, 1984). The study found no shortage of alternative disposal sites, such as abandoned gravel pits, despite claims to the contrary by the development industry. However, as the waterfront is closer to downtown development than are the alternatives, the quickest and cheapest way for the development industry to dispose of its waste material is to take it to the waterfront. Public and private utilities that

undertake projects involving excavation resort to the same practice (Environmental Applications Group, 1988).

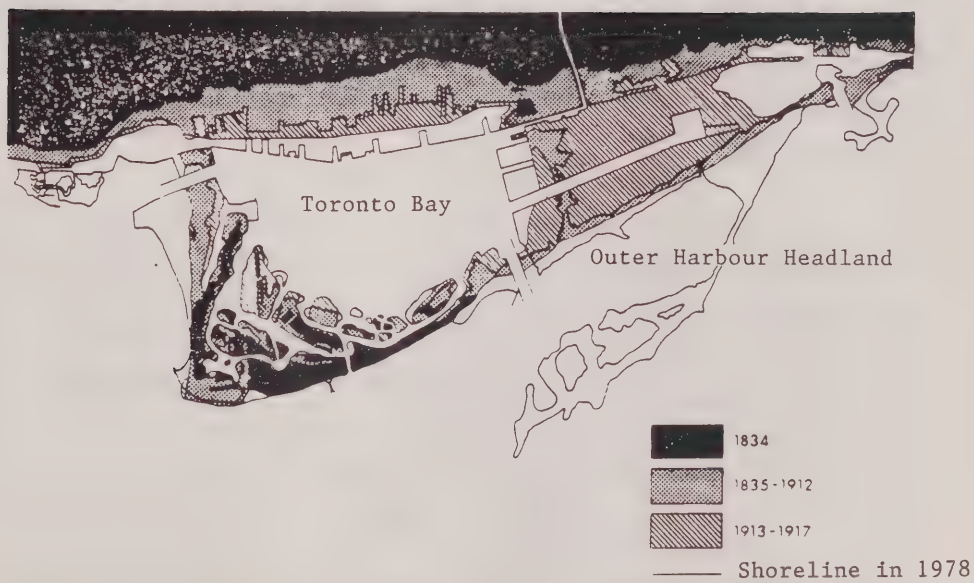
While there appears to be general acknowledgement that the outer harbour has been an important waste-disposal site for material from excavations and demolitions, there appears to have been little attention paid to the other types of waste that have been dumped there. The primary objective of this paper is to show the significance of those other waste materials in land-creation operations in Toronto. The paper pursues this objective by documenting the disposal of coal ash from the Hearn thermal generating station at the outer harbour. In light of the lack of public and scholarly awareness of the use of the outer harbour as a disposal site for materials other than excavation and demolition waste, it is hoped that the paper will prove to be a useful contribution to our knowledge of the Toronto waterfront.

The remainder of this chapter presents a brief survey of literature regarding the types of fill material used in land creation in other cities, and a discussion of the one systematic study that does exist regarding the types of fill material available in Toronto. The following chapter sets out the history of land-creation operations at the outer harbour, focussing on the disposal of coal ash. Conclusions based on the material reviewed are presented in the third and final chapter.

The most commonly used material in urban land-creation projects around the world appears to be so-called 'clean' fill, comprising earth, rock and rubble from excavation and demolition activities. Sources of such material have included the levelling of hills, which has been common practice in Hong Kong for decades (Bristow, 1984), construction sites (Progressive Architecture, 1967), building demolitions (Chiu, 1973), and railway and subway excavations (Bird, 1968, Krieger and Green, 1985). It has been pointed out that urban waterfronts often provide convenient disposal sites for clean fill simply because they are relatively close to downtown construction sites in most cases (Environmental Applications Group, 1988).

Vast amounts of domestic garbage and street sweepings have been used for land-creation purposes in many cities, including Boston (Whitehill, 1968), San Francisco (San Francisco, 1969), New York (Scardino, 1987) and Hong Kong (Lumb, 1976). The following description of Kwun Tong 'reclamation' in Hong Kong forty years ago would most likely have been applicable to filling operations in a great number of cities: "[The site] was nothing more than a public rubbish dump,

MAP 1: Land Creation around Toronto Bay



Source: Wilson (1978).

and the fill placed there included domestic sewage, empty oil drums, hardcore, timber, and, on occasion, some soil."¹

Although heightened environmental awareness has resulted in stricter controls over filling operations in recent decades, domestic garbage is still a common fill material in Japan (Shindoh and Suzuki, 1988), and is used sometimes in the United Kingdom (Gray, 1977). Industrial waste, such as slag from steelworks and pulverised coal ash from thermal power stations, is also used as fill material (Gray, 1977; Dames and Moore, 1978; Hudson, 1979), but less often, apparently.

Material dredged from harbour bottoms is commonly used as fill material (Hudson, 1979), as it has been for many decades. Such material is in abundant supply because many waterways must be dredged regularly if navigability is to be maintained. One notable source of information on disposal options for dredged material, including its use in land creation, is the work of the United States Army Corps of Engineers in an extensive research programme conducted through the 1970s and 1980s (United States, 1986).

The types of fill material used or considered for use in land-creation operations in Toronto in recent decades correspond to those four general categories of waste material—clean fill, domestic garbage, dredged material and industrial waste. They do not appear to have been subjected to much analysis or discussion in Toronto, and the most comprehensive look at the local situation remains a study of 'land fill' prepared in 1964 by consultants to the Municipality of Metropolitan Toronto.² Operating under the premise that there was a need for new land along the shoreline,³ the consultants noted that the following sources of fill warranted consideration:

- clean fill, comprising excavated earth and rock, and demolition and construction rubble
- material dredged from the lake and harbour
- municipal refuse (and incinerator ash)
- digested sewage sludge (and incinerator ash)

¹ Lumb (1976), p. 305.

² Proctor *et al* (1964).

³ Proctor *et al* (1963).

- ash from the burning of coal at thermal generating stations.⁴

The first two classes—clean fill and dredged material—have been used for decades as fill material along the Toronto waterfront, and account for most of the total amount of fill material used in land creation in the city. There is ample documentation of the use of excavated material in land creation in the decades both before and since the release of the consultants' report.⁵ During the 1950s and 1960s, excavations for the subways, downtown bank towers and many other projects provided the large volumes of clean fill used in the construction of the Queen Elizabeth Docks, the outer harbour headland, and the land base for Ontario Place.

While material dredged from Toronto Bay and Lake Ontario had been the principal filling material in the construction of the Port Industrial District,⁶ the 1964 study estimated that dredged material would account for less than 10 percent of the total volume of fill material used over the 20 years to 1985.⁷ The reason given for the decline in importance was that the then-recent completion of dredging of the harbour and its approaches to St. Lawrence Seaway depth would mean that only limited amounts of dredged material would be available for land-creation purposes.

For the purposes of the 1964 report the consultants defined 'refuse' as comprising domestic garbage, rubbish, ashes, street refuse, and industrial waste.⁸ Despite the fact that refuse comprised about 55 percent of all fill material available, it was recognised that such material could only be used in land-creation schemes if endikements to contain the material were provided, along with sufficient cover of clean fill. The consultants cited several local examples of the successful use of refuse for land creation, and saw the use of refuse as having great potential in land creation, provided that proper measures were taken to contain the material. However, they pointed out that the usefulness of refuse in the harbour area would be limited by the need for material with high load-bearing capacity due to the likelihood of commercial and industrial development in that area.

⁴ Proctor *et al* (1964), p. 2.

⁵ See THC annual reports, THCA RG 1/2 boxes 1, 2, 3, 4.

⁶ Moir (1988); and THC annual reports, THCA RG 1/2 box 1.

⁷ Proctor *et al* (1964), p. 26.

⁸ Proctor *et al* (1964), p. 5.

Digested sewage sludge was considered by the consultants to be negligible as a source of fill material,⁹ presumably because of the practical difficulties in transportation and handling. While it was noted that the Metropolitan Toronto Works Department had recently endiked and drained a small area of the lake at the edge of the Main sewage treatment plant for the disposal of sewage sludge,¹⁰ this was apparently not seen as a technique with broader utility. Documents reviewed during the present research contain no indication that sewage sludge, or ash from incinerated sludge, has been used in land creation elsewhere.

At the time of the 1964 study, coal ash was produced locally at the Hearn generating station in Toronto and the Lakeview generating station in what is now Mississauga. Coal ash consists of fly ash, which is fine-grained and very light, and bottom ash, which is much coarser and heavier.¹¹ It was the consultants' opinion that both types of ash could be used as fill material if adequately confined and covered. The consultants recommended that the possibility of obtaining fly ash for use as fill be explored further.¹² Apparently they were not aware that fly ash from the Hearn station had already been used as fill material at the outer harbour for about ten years, as is fully discussed in the following chapter.

The consultants' findings were considered crucial to the formulation of the waterfront plan for the metropolitan area,¹³ which was released in December 1967 after five years of work. The 1967 metropolitan waterfront plan called for the creation of large tracts of new land for parks along the lakeshore to the east and west of the City of Toronto, and for an ambitious port-and-airport redevelopment scheme around the inner harbour and the Port Industrial District flanking it. The concept for the central harbour area, which was never implemented, included three principal components, all of which called for the creation of large amounts of new land. Those components were: a housing development for 60,000 people on the site of the Toronto Island Airport; a newly

⁹ Proctor *et al* (1964), p. 28.

¹⁰ Proctor *et al* (1964), p. 5.

¹¹ Proctor *et al* (1964), pp. 12, 13.

¹² Proctor *et al* (1964), p. 40.

¹³ Proctor *et al* (1967).

created land mass south of the existing island to accommodate the relocated airport; and a greatly expanded Port Industrial District centred on a newly enclosed outer harbour south of Unwin Avenue.

It is clear that implementation of the 1967 plan depended largely upon land creation. However, it is also clear that the authors of the plan recognised that land creation had benefits in addition to the provision of land to accommodate new facilities:

"The lake should continue to be used for the disposition in a constructive way of surplus fill from building sites and public works projects within economic haul distances. In this way, worthwhile additions can be made to the waterfront, while lower construction costs can be obtained on building projects.

"Waste materials such as hydro flyash, certain solid industrial wastes, dredged silts, demolition wastes, garbage, rubbish, incinerator residues, digested sludge, etc. should be used for constructive purposes wherever feasible."¹⁴

Although the use of coal ash figured prominently in the 1964 consultants' study and the 1967 metropolitan waterfront plan, it has received singularly little attention since. The disposal of coal ash at the headland does not appear to have been mentioned in material that is accessible to the public until the release of a report by the federal and provincial environment ministries in 1982. That report noted only that the practice had been stopped in the 1970s.¹⁵ Two reports prepared in 1990 by soils consultants noted that ash was found mixed with soil south of Unwin Avenue,¹⁶ but these reports are not widely available. Other references to coal-ash disposal at the headland clearly borrow from those few reports.¹⁷ •

The following chapters attempt to address this general lack of information.

¹⁴ Proctor *et al* (1967), p. 8.

¹⁵ Environment Canada *et al* (1982), p. 4.

¹⁶ CH2M Hill (1990); and M.M. Dillon (1990).

¹⁷ Sarazin (1986) follows Environment Canada *et al* (1982); Munson (1990) follows Proctor *et al* (1964); Intera Kenting (1990) follows CH2M Hill (1990) and M.M. Dillon (1990). Coal ash was given only passing reference (i.e., Intera Kenting) in the Environmental Audit of the East Bayfront and Port Industrial Area conducted by the Royal Commission on the Future of the Toronto Waterfront.

LAND CREATION AT TORONTO'S OUTER HARBOUR

The Filling of Ashbridge's Bay

The town of York, which grew to be the city of Toronto, was first settled by Europeans in 1793. At that time, Ashbridge's Bay consisted of some 1300 acres of marsh area enclosed by sandspits at the eastern flank of Toronto Bay (or Harbour),¹⁸ as shown on Map 2. Over the next century a combination of urban effluent carried by the Don River and wastes from a distillery and cattle-fattening operation turned a portion of the marsh into what was regarded by some as a hazard to human health.¹⁹ Some combination of concern for public health and desire for new sites for anticipated industrial development led to widespread acceptance of the idea that Ashbridge's Bay should be filled.²⁰

Several schemes to fill Ashbridge's Bay were proposed during the late 1800s,²¹ but very little was done prior to the November 1912 release of an ambitious waterfront plan by the newly established Toronto Harbour Commissioners (THC).²² The THC had been established in 1911 by the Federal Government to manage the port and harbour of Toronto, and to undertake the general development and improvement of the city's waterfront.²³ The THC Board consisted of five members—three designated by the City of Toronto, and two designated by the federal government. One of the federal designates was to be nominated by the local Board of Trade. The THC's 1912 plan divided the waterfront of the city into three sectors. The western sector, between the Humber River and Bathurst Street, was to feature parks and boulevards laid out on newly created land along the existing shoreline. The central sector, along the harbour between Bathurst and Cherry Streets, was to be reserved mainly for commercial and port development.

¹⁸ Desfor (1988), p. 77.

¹⁹ Keating (1892).

²⁰ O'Mara (1976), p. 27.

²¹ O'Mara (1976), p. 27.

²² Toronto Harbour Commissioners (1912).

²³ Toronto Harbour Commissioners (1912), p. 3.

The centrepiece of the plan for the eastern sector, between Cherry Street and Victoria Park Avenue, was a large industrial district on land to be created by the filling of Ashbridge's Bay, as shown on Map 3. Although the City had transferred ownership of most of its waterfront land and parcels of surveyed land covered by water (i.e., waterlots) to the THC in 1911,²⁴ and reached agreement with the THC regarding implementation of the entire plan for the waterfront in 1914,²⁵ the filling of Ashbridge's Bay to create the Port Industrial District was not completed until the 1930s. This was despite an acceleration of land-creation efforts there in response to the demand for additional industrial capacity brought by the first world war.²⁶

Filling Along the Shoreline, 1949-1964

It is unlikely that the THC seriously considered creating additional land in the vicinity of the Port Industrial District during the years of the great depression and the second world war. In March 1948, however, the potential of the booming post-war economy moved senior staff of the THC to consider overall planning for the future.²⁷ One possibility considered was expansion of the port district south of Unwin Avenue and development of an outer harbour, a dormant concept that had surfaced a number of times in various proposals during previous decades.²⁸ This initiative was bolstered in early 1949, when the Hydro-Electric Power Commission of Ontario (Ontario Hydro) and the Consumers' Gas Company both expressed interest in purchasing THC land near the southeast corner of the Port Industrial District to accommodate new operations. Following negotiations, the THC was able to satisfy the requirements of both parties.²⁹ Ontario Hydro received a site south of the Ship Channel, as shown on Map 4, on land that was partly under water

²⁴ "The Corporation of the City of Toronto to the Toronto Harbour Commissioners, Conveyance of Lands", 26 December 1911, THCA RG 12/3/15.

²⁵ City of Toronto Council minutes, 26 November 1914.

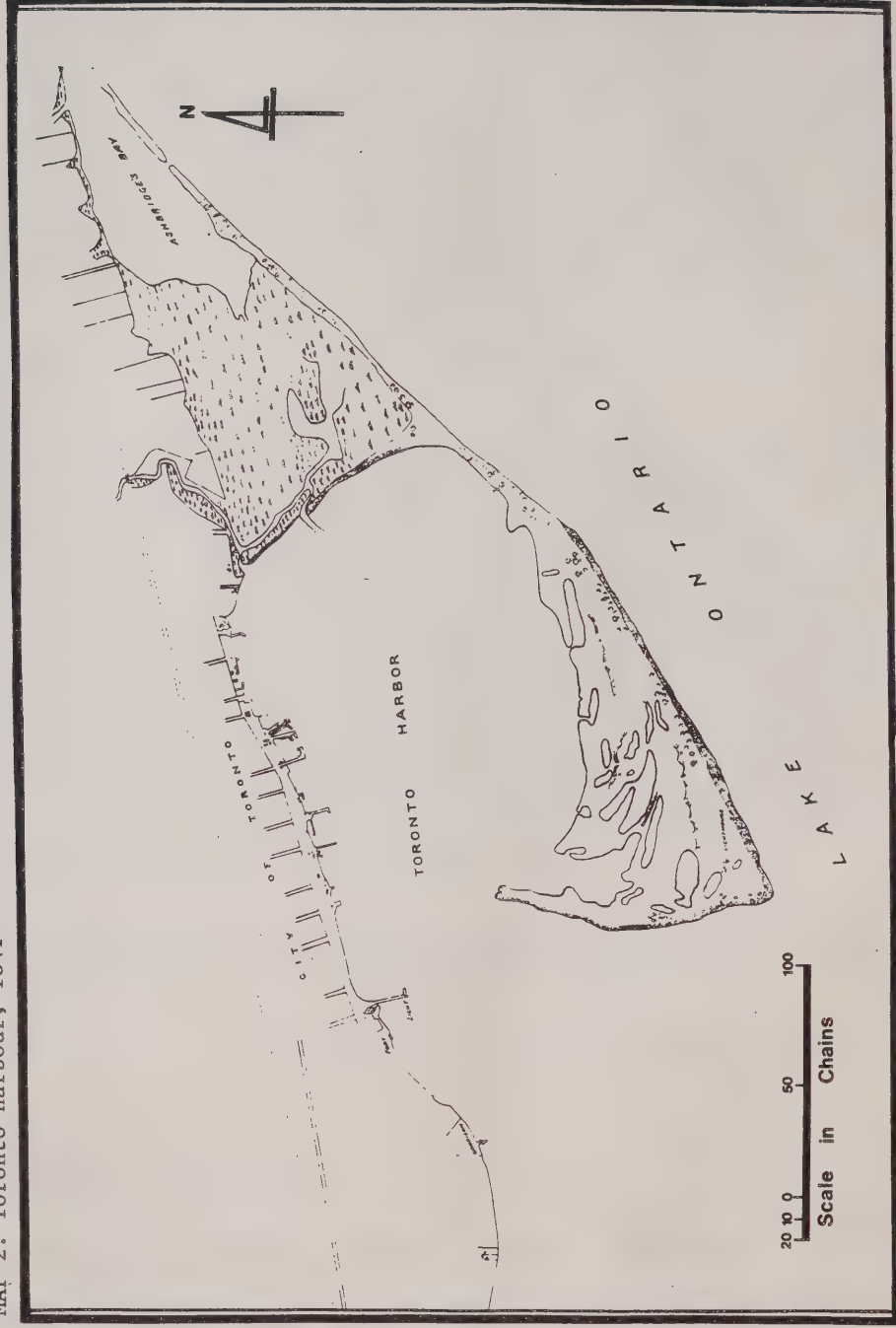
²⁶ Moir (1988).

²⁷ THC Board minute, no. 15317, 13 April 1948, THCA RG 3/3 box 238 folder 19.

²⁸ See Merrens (1988) for an extensive discussion of the outer harbour concept.

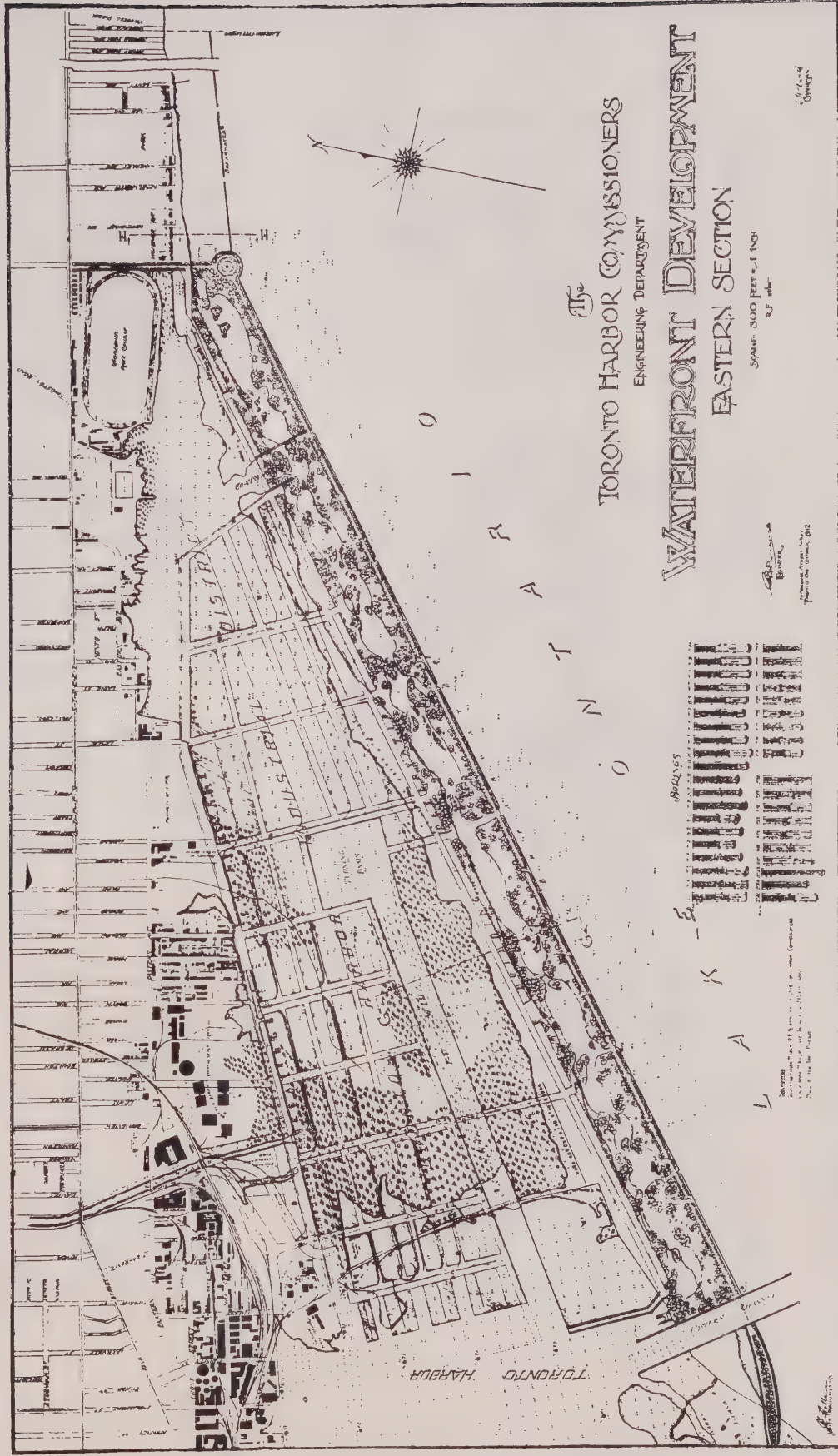
²⁹ City of Toronto Board of Control, Report No. 10, considered by City of Toronto Council on 25 March 1949, THCA RG 3/31 box 2 folder 1.

MAP 2: Toronto Harbour, 1841



Source: Richardson (1980).

MAP 3: Planned Port Industrial District, 1912



at the time, and construction of the R.L. Hearn Thermal Generating Station soon began.

Emboldened by its success in dealing with Ontario Hydro and Consumers' Gas, the THC released a new plan for the development of the central waterfront in March 1949. The plan featured a new port area on newly created land to extend up to 2000 feet south of the existing shoreline between the Eastern Channel and Coatsworth Cut.³⁰ Anchorages along the south side of this new port area were to be protected by two breakwater walls—one parallel to the new shoreline, and the second curving south and west from the foot of Woodbine Avenue. It was reported that about 700 acres would be filled,³¹ and that the plan would take 50 years to complete.³²

The THC commenced land-creation operations to extend the shoreline southward in accordance with the new scheme for the outer harbour. Operations were concentrated initially on filling to raise the water-covered portions of the Hearn site, which the THC was obligated to complete before the sale of the entire site could be finalised. Compared to later years, the volumes of clean fill accepted for disposal by the THC were not great. About 85,000 cubic yards of fill were received in 1952, and only a portion of that went to the outer harbour—to a location west of the Circulating Channel.³³

The idea of using ash from the burning of coal at the Hearn station as fill material surfaced early, almost as soon as the first of an eventual eight operating units at the station went into service in November 1950.³⁴ Two months later, staff from Ontario Hydro were approaching the THC regarding disposal of ash at the waterfront.³⁵ By the end of February 1952, with THC

³⁰ The *Toronto Star*, 25 March 1949.

³¹ The *Toronto Star*, 26 March 1949.

³² The *Globe and Mail*, quoting the THC's consultant (and former General Manager), E.L. Cousins, 26 March 1949.

³³ THC *Annual Report* 1952, THCA RG 1/2 box 2 folder 22.

³⁴ Garcia-Lee (1990b).

³⁵ THC memorandum from W. Rest, Director of Planning to F.R. Scandrett, General Manager, 14 December 1951, THCA RG 3/3 box 165 folder 11.

approval,³⁶ ash was pumped through an "ash disposal overflow line" leading to the Circulating Channel from an ash storage area on the Hearn site north of the shoreline.³⁷ Until 1959 all ash from the Hearn station, both bottom ash and fly ash, was conveyed by water to the storage area, a settling pond next to the generating station, before being pumped or trucked to final disposal sites.³⁸ Correspondence between the THC and Ontario Hydro referred to 'ash' and 'fly ash', but not 'bottom ash', and it is not clear if the intention was to exclude bottom ash, or if the wording of agreements had the effect of doing so. Bottom ash, being heavy and granular, may well have been considered to be 'clean fill' requiring no special attention (or expense) on the part of the THC. It is clear, as will be seen, that both fly ash and bottom ash from the Hearn station were deposited at the outer harbour in later years.

In January 1953, Ontario Hydro applied to the THC for permission to install piping to convey ash "into the lake on the shore south of the station site and west of the Circulating Channel".³⁹ Ash was to be sluiced to Lake Ontario via a 14-inch pipe across Unwin Avenue and under a THC railway track. The THC approved of the proposal on a three-month trial basis, with the possibility of a permanent agreement should the tests prove satisfactory.⁴⁰ It was recognised that measures to contain the material might be required should the floatable fine ash cause "any unsightly mess or nuisance at the beaches or in the harbour", in which case some form of enclosure could be installed.⁴¹ The discharge pipe was in operation within a month.⁴²

³⁶ THC Board minute no. 17242, 12 February 1952, THCA RG 3/3 box 165 folder 12.

³⁷ Letter from S.L. Fear, Liaison Engineer, Ontario Hydro to the attention of F.R. Phillips, Acting Chief Engineer, THC, 27 February 1952, THCA RG 3/3 box 165 folder 12.

³⁸ Garcia-Lee (1990a).

³⁹ Letter from E.B. Easson, Secretary, Ontario Hydro to the attention of E.B. Griffith, General Manager, THC, 15 January 1953, THCA RG 3/3 box 165 folder 13.

⁴⁰ Letter from F.R. Phillips, Acting Chief Engineer, THC to the attention of Easson, Ontario Hydro, 26 January 1953, OHA 010—R.L. Hearn.

⁴¹ THC memorandum from Phillips to Griffith, 19 January 1953, THCA RG 3/3 box 165 folder 13.

⁴² THC memorandum from Phillips to file, 10 February 1953, THCA RG 3/3, box 165,

At the end of the three-month trial period, in April 1953, the THC approved construction of an endikement to contain the ash,⁴³ as shown on Map 5. The decision was based on economic rather than aesthetic or environmental considerations, as the THC recognised that settled fly ash had a high load-bearing capacity, and that measures should therefore be taken to prevent its loss to the lake.⁴⁴ It was decided that a special dump site for about 100,000 cubic yards of fly ash should be created by excavating at the shoreline just west of the Circulating Channel. In February 1954, by which time the first ash-disposal area was already within a few weeks of being completely filled, the THC approved Ontario Hydro's application to open a new endiked disposal area on the east side of the Circulating Channel.⁴⁵

Whatever the THC's ambitions for the outer harbour, the creation of land there was constrained by the concentration of resources on the construction of the Queen Elizabeth Docks between Yonge and Parliament Streets. Appreciable quantities of clean fill were trucked to the outer harbour for the first time in 1955, when the docks were completed. All but 37,000 of the 207,500 cubic yards of earth fill received by the THC during that year were directed to the outer harbour area, whereas it appears that little trucked fill had been directed to the outer harbour earlier in the 1950s.⁴⁶ While some proportion of the 85,000 cubic yards of clean fill received by the THC in 1952 was placed south of Unwin Avenue, it appears that none of the 380,000 cubic yards of trucked fill received in 1953 and 1954 was directed to the outer harbour.

Because the diversion of clean fill elsewhere would not have affected the operation of the ash-disposal area at the outer harbour, it appears likely that the largest proportion of the fill material used to complete the Hearn site was coal ash. Although the THC was obligated to complete the land base of the Hearn site, Ontario Hydro had retained the right to create part of the new site using

folder 13.

⁴³ THC Board minute no. 17629, 7 April 1953, THCA RG 3/3 box 165 folder 13.

⁴⁴ THC memorandum from Phillips to Griffith, 31 March 1953, THCA RG 3/3 box 165 folder 13.

⁴⁵ THC Board minute no. 17710, 23 February 1954, THCA RG 3/3 box 165 folder 13.

⁴⁶ THC annual reports, THCA RG 1/2 boxes 2, 3.

coal ash from the Hearn station, providing that the ash was contained.⁴⁷ (This agreement was reached after Ontario Hydro had ceased to emit coal ash directly into the Circulating Channel or Lake Ontario.) The Hearn site was not completed until mid 1956,⁴⁸ although the Hearn station itself had gone into service in 1951. The THC eventually conveyed 52 acres of land to Ontario Hydro, but not until 1959.⁴⁹ The initial delay to 1956 appears to have been due to the absence of legal authority for the THC to sell its waterlots. The period between 1956 and 1959 was characterised by protracted negotiations over other matters that have no bearing on the current study.

With the completion of the Queen Elizabeth Docks and the fulfilment of its obligations at the Hearn site, the THC was free to focus its efforts on creating an outer harbour in the second half of 1956. The principal location of THC land-creation operations from then until 1959 was the area of the shoreline south and southwest of the Hearn site, although some fill material was placed near the foot of Leslie Street so as to protect a railway line then threatened by erosion of the shoreline.⁵⁰ Large quantities of trucked fill material were dumped at water's edge south of Unwin Avenue (130,000 cubic yards in 1956, 200,000 in 1957 and 80,000 in 1958⁵¹), including coal ash from the ash storage area on the Hearn site.⁵² The coal ash was blended with clean fill (five parts clean fill to one part ash in May 1957⁵³) prior to placement. Coal ash from the Hearn station was also used in the refilling of the northern portion of the Circulating Channel during the first few months

⁴⁷ THC memorandum from W.M.H. Colvin, Solicitor to Griffith, 18 August 1953, THCA RG 3/3 box 165 folder 13.

⁴⁸ THC Board minute no. 19322, 30 October 1956, THCA RG 3/3 box 165 folder 15.

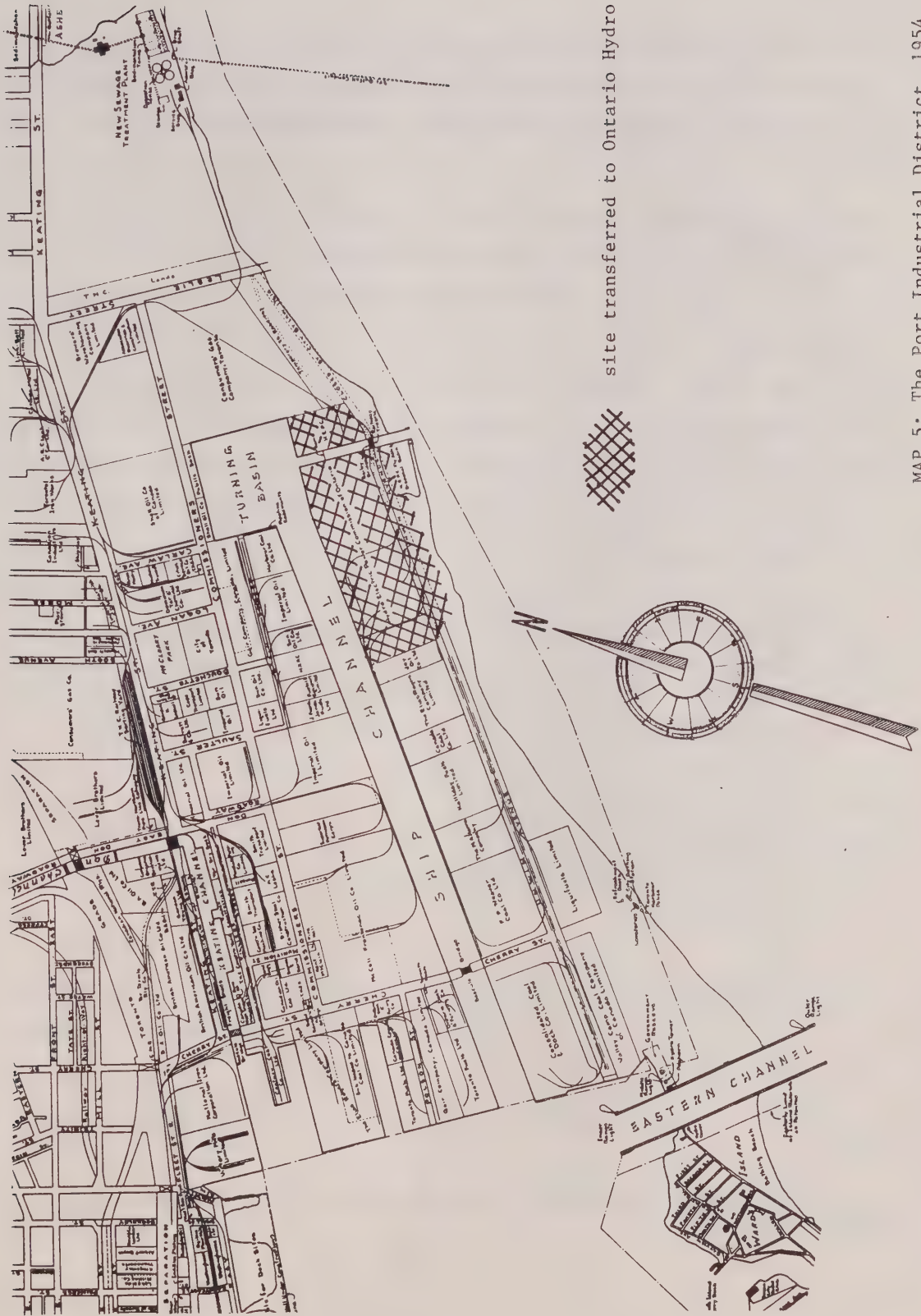
⁴⁹ THC memorandum from Colvin to Griffith, 7 May 1959, THCA RG 3/3 box 166 folder 1.

⁵⁰ Fricbergs (1989).

⁵¹ Richardson (1980), p. 16, based on THC drawings.

⁵² THC Board minute no. 19322, 30 October 1956, THCA RG 3/3 box 165 folder 15.

⁵³ Garcia-Lee (1990a).



MAP 5: The Port Industrial District, 1954

of 1957.⁵⁴ About 40,000 cubic yards of ash per year were being removed from the storage area on the Hearn site at the time,⁵⁵ and it is probable that all of it was taken for disposal at THC land-creation operations at the outer harbour, quite possibly with additional ash from current operations of the Hearn station.

Measures to protect newly placed fill material from erosion by wave action were suggested by senior THC staff in early 1958, in response to a request from the General Manager.⁵⁶ In terms of daily operations, THC staff began to segregate sand and earth from rubble, which could be used to protect the shoreline.⁵⁷ In terms of longer-term planning responses, the Director of Planning⁵⁸ and the Chief Engineer⁵⁹ both suggested the extension of a conventional protective headland southward from the bank of Coatsworth Cut. Their suggestions were not acted upon, although they are similar in some respects to the outer harbour headland that was eventually built several years later, as is discussed in the following section. It should be noted that whereas conventional headland technology called for either a self-supporting pile of rubble or a rock-in-crib wall with a concrete topping, the eventual outer harbour headland was innovative in that its core was earth; only 'armouring' to prevent erosion was of rubble and stone.

In 1959 the site of land-creation operations in the port area was shifted to the foot of Leslie Street, where considerable unfilled acreage was still available within the THC waterlot. Volumes of fill material were gradually increasing, due to a construction boom then taking place in downtown Toronto. Most of the half-million cubic yards of fill material received each year at the foot of

⁵⁴ Letter from R.E. McGrew, Superintendent of Construction, Stone and Webster Canada Limited to Griffith, THC, 31 January 1957, THCA RG 3/3 box 165 folder 16. (Stone and Webster was, and is, Ontario Hydro's engineering consultant for the Hearn station.)

⁵⁵ Garcia-Lee (1990a).

⁵⁶ THC memorandum from J.H. Jones, Chief Engineer to Rest, 6 February 1958, THCA RG 3/3 box 238 folder 20.

⁵⁷ *THC Annual Report* 1958, THCA RG 1/2 box 3 folder 5.

⁵⁸ THC memorandum from Rest to Griffith, 10 February 1958, THCA RG 3/3 box 238 folder 20.

⁵⁹ THC memorandum from Jones to Griffith, 14 February 1958, THCA RG 3/3 box 238 folder 20.

Leslie Street in the early 1960s came from excavation sites downtown, including a very substantial proportion (42 percent in 1962) from subway construction.⁶⁰ Although stated THC policy was to accept only clean or solid material at the filling site,⁶¹ tin cans from the municipal incinerator on Commissioners Street and fly ash from the Hearn station were accepted as well,⁶² and were spread over an area away from the water's edge. The THC had attempted to construct an enclosed basin for ash from the municipal incinerator in 1958, with the approval of the Ontario Water Resources Commission (OWRC), but storms during the following Spring had washed away the endikement that had been built.⁶³ At the time the OWRC was a new agency established to administer the Ontario Water Resources Act of 1957.

The use of the ash storage area on the Hearn site was discontinued in 1959, when alternative storage systems were installed for both fly ash and bottom ash.⁶⁴ At the same time, Ontario Hydro began contracting private haulers to truck dampened ash from the Hearn station.⁶⁵ With this movement to the use of private haulers, and a concurrent shift of THC land-creation operations from the Hearn site to the foot of Leslie Street, there was less need for regular correspondence between Ontario Hydro and the THC. Consequently, ash-disposal figures were not readily available for review during the current research, and must be estimated on the basis of coal consumption and the ash-disposal records of earlier and subsequent years. The correspondence that does exist shows that neither Ontario Hydro nor the THC appeared to know how to deal with fly-ash disposal.

Despite Ontario Hydro's new practice of contracting out ash disposal, it was not able to avoid all responsibility for the by-products of its operations. A letter of complaint from THC staff in

⁶⁰ THC drawing no. 14322, 18 June 1964, THCA RG 3/3 box 238 folder 21.

⁶¹ *THC Annual Report 1963*, THCA RG 1/2 box 3 folder 10.

⁶² Letter from J.R. Clark, Assistant Chief Engineer, THC to the attention of A.W. Smith, Manager, Central Region, Ontario Hydro, 15 September 1960, OHA 010—R.L. Hearn.

⁶³ Fricbergs (1989), p. 8.

⁶⁴ Garcia-Lee (1990a).

⁶⁵ Letter from Clark, THC to the attention of Smith, Ontario Hydro, 15 September 1960, OHA 010—R.L. Hearn.

October 1962 noted that private haulers were dumping fly ash right into Lake Ontario from THC land south of the plant.⁶⁶ This had been going on since May 1961, apparently, and the THC had become concerned that: "fly ash in the water may be carried some distance along the shore and out into the lake as proved by tests [the THC] carried out several years ago."⁶⁷ The letter went on to say that future use of THC land for the disposal of fly ash would be allowed only after Ontario Hydro had developed a "satisfactory treatment method", and that the THC was willing to make space available on the headland for experimental work on the disposal of fly ash.

At the end of 1963, Ontario Hydro staff contacted the THC to suggest that field tests be undertaken to determine means of disposing of fly ash.⁶⁸ By February 1964 the THC was inviting Ontario Hydro to conduct further experiments on the THC's newly created land.⁶⁹ A trial of some sort did take place, but was discontinued, apparently due to THC concern that it would not be able to ensure that the large quantities of ash to be received would be mixed with earth fill in the proper proportions.⁷⁰ (The THC had continued to accommodate relatively small amounts of coal ash collected from customers by household fuel companies through the early 1960s;⁷¹ records show that 533 loads of fly ash were received at the foot of Leslie Street in 1963.⁷²) It is somewhat ironic that the 1964 test did not result in a large-scale programme of fly-ash disposal at the foot of Leslie Street, because in November 1964 the Municipality of Metropolitan Toronto was advised by its

⁶⁶ Letter from Jones, THC to the attention of R.B. Scarrow, Acting Station Superintendent, Ontario Hydro, 5 October 1962, OHA 010—R.L. Hearn.

⁶⁷ THC memorandum from Clark to Griffith, 21 September 1962, THCA RG 3/3 box 351 folder 15.

⁶⁸ Letter from D.G. Watt, Engineer-in-Charge, Structural Research Department, Ontario Hydro to Jones, THC, 13 December 1963, THCA RG 3/3 box 351 folder 16.

⁶⁹ Ontario Hydro memorandum from C.J. Drew, Manager, Lakefront Area to A.W. Smith, Manager, Central Region, 5 February 1964, OHA 010—R.L. Hearn.

⁷⁰ Fricbergs (1965), p. 56.

⁷¹ Letter from Jones, THC to the attention of Smith, Ontario Hydro, 12 July 1960, THCA RG 3/3 box 351 folder 15.

⁷² THC report, "Disposal Area Data", THC Board minute no. 24100, 7 April 1966, THCA RG 3/3 box 260 folder 4.

consultants to pursue the possibility of using 'hydro ash' in land-creation schemes undertaken along the metropolitan waterfront,⁷³ as discussed in the previous chapter.

Creating the Outer Harbour Headland, 1965-1977

By 1964 a new approach to land creation at the outer harbour appeared to be required. Negotiations between the THC and the province to secure a large new waterlot for the outer harbour development were proving unproductive, and there was concern that the THC would not be able to accommodate the enormous amount of excavated material available as a result of construction of the Bloor-Danforth and University subway lines by the Toronto Transit Commission.⁷⁴ The concern shown suggests that the outer harbour had come to be seen as the disposal site of choice for generators of clean fill, and statistics regarding volumes of fill material bear this out. In 1964, 1.4 million cubic yards of fill were trucked to the headland, double the total for the previous year; the figure did not drop significantly below 1 million cubic yards per year until 1974.⁷⁵ In October 1964 the THC board approved a staff suggestion that fill be placed so as to form two headlands enclosing a new harbour rather than along the shoreline,⁷⁶ although in truth the THC had been placing fill to form the bases of the two headlands throughout 1964. The western-most headland, to the southwest of the Hearn site, was aborted by the end of the following year.⁷⁷ The THC annual report for 1965 contains a succinct description of what the new, single-headland approach meant to filling operations: "The fill conveyed to the Leslie Street site by truck from various construction projects in the City and which formerly had been placed to

⁷³ Proctor *et al* (1964).

⁷⁴ Ontario Hydro memorandum from Drew to Smith, 5 February 1964, OHA 010—R.L. Hearn.

⁷⁵ Richardson (1980), p. 16, from THC drawings.

⁷⁶ THC memorandum from Jones to Griffith, 7 October 1964, THCA RG 3/3 box 238 folder 20.

⁷⁷ THC drawing no. 14270-D, 16 December 1965, THCA RG 3/3 box 238 folder 21.

form large blocks of land, was concentrated into a long headland extending parallel to the shoreline".⁷⁸

The headland approach had a couple of advantages. One was that it avoided the clear need for title to a waterlot on which to create land. As a breakwater for navigational purposes, the headland could be built with federal approval only, under the Navigable Waters Protection Act. A second and more important advantage was that it provided a low-cost breakwater using material that the THC was already accepting at the outer harbour. A third advantage was that, as discussed above, a strategically located headland protects fill material placed along the shoreline from erosion. Additionally, later THC reports emphasised that the purpose of the headland was not only to enclose a harbour, but also to protect Toronto Island from "destructive easterly waves",⁷⁹ and to stop the gradual siltation of the Eastern Channel by sand shifting along the shore from farther east.⁸⁰

THC staff had investigated the possibility of constructing a single long headland (or mole) using quarried rock in 1962, and had found that it would cost about \$25 million.⁸¹ Such an investment was judged to be unsupportable, as significant returns would not begin for 20 years. In contrast, "an earth-core, rubble-protected mole was estimated to cost \$1,000,000 in 1962 dollars." It is likely that a number of other headland configurations were investigated as well. For example, the Metropolitan Toronto Works Department had prepared, doubtless with considerable input from THC staff, a report regarding the construction of a recreational boating basin south of the city's main sewage treatment plant, which occupies a site owned by the THC on the east side of Leslie Street. Two options were presented—two small headlands extended south from land east of Coatsworth Cut, and two headlands extended eastward from the existing THC filling operations at the foot of Leslie Street.⁸²

⁷⁸ *THC Annual Report* 1965, p. 6, THCA RG 1/2 box 3 folder 12.

⁷⁹ *Toronto Harbour Commissioners* (1972), p. 14.

⁸⁰ Jones (1968), p. 14.

⁸¹ Fricbergs (1985), p. 6.

⁸² *Metropolitan Toronto* (1963).

Details of the THC's new plans for the outer harbour, including the single headland, were released to the public in January 1966.⁸³ Deep-water docks along the shoreline south of Unwin Avenue remained from earlier concepts, but only along the eastern half of the new shoreline. The western half was shown as having an irregular edge, suggesting that it was intended to be for parkland. The THC was predicting substantial growth in ship traffic to and from Toronto, and foresaw a need for new land within five years to accommodate the additional port-related facilities that such growth would entail.⁸⁴ (This optimism was not substantiated by a federal study undertaken during this period. That study concluded that further work on port development could not be justified if the sole purpose was to accommodate shipping.⁸⁵)

The importance of the headland as a disposal area for clean fill was increasing, as is shown by the fact that fill material was being brought there from points much further north and west than had been the case in previous years.⁸⁶ In 1966 the headland was progressing at a very rapid rate without benefit of engineering studies, simply because fill was available. As was admitted by the THC at the time: "[T]he Commission has been taking advantage of the Toronto building boom which has required a convenient disposal area for millions of tons of earth from excavation".⁸⁷

The attractiveness of the headland as a disposal site for waste materials other than clean fill was also apparent, as Ontario Hydro approached the THC towards the end of 1966 to discuss the possibility of once again accepting fly ash from the Hearn station.⁸⁸ It seems that Ontario Hydro was having some difficulty in disposing of its ash in an environmentally sound manner. THC staff

⁸³ The *Toronto Star*, 14 January 1966.

⁸⁴ Letter from Jones, THC to R.P. Henderson, District Engineer, Harbours and Rivers Engineering Branch, Department of Public Works Canada, 15 August 1966, THCA RG 2/3 box 238 folder 22.

⁸⁵ Gibb *et al* (1969).

⁸⁶ THC *Annual Report* 1967, p. 7, THCA RG 1/2 box 3 folder 14.

⁸⁷ Letter from Jones, THC to R.P. Henderson, District Engineer, Harbours and Rivers Engineering Branch, Department of Public Works Canada, 15 August 1966, THCA RG 3/3 box 238 folder 22.

⁸⁸ THC memorandum from Griffith to Jones, 7 October 1966, THCA RG 3/3 box 351 folder 16.

had in fact measured the amount of fly ash contained in the "very black water" being emitted into the Circulating Channel from cooling water conduits at the Hearn station, and calculated that 125,000 cubic yards of fly ash per year were being released in that manner (assuming a constant rate). THC concern regarding this situation was brought to the attention of Ontario Hydro,⁸⁹ and, in an effort to find an alternative means of disposing of the ash, engineering staff from the THC and the OWRC agreed in March 1967 to undertake a trial project whereby fly ash would be placed at the outer harbour headland.⁹⁰

Testing to evaluate bearing capacity and effects of coal ash on water quality and the lakebed was carried out over six weeks in May and June 1967. It is clear from the nature of the testing and the description of results that fly ash was mixed with earth fill and placed directly into Lake Ontario, and not away from the water's edge or behind an endikement.⁹¹ Tests were observed by staff of the OWRC and the Metropolitan Toronto Works Department, of whom THC staff noted: "[W]hile they do not wish to be in a position of officially approving, they have at the present time, no objection to the methods that we were using."⁹²

One reason for the agencies' reticence may have been that they were all involved at the time in the planning exercise that was soon to culminate in the release of the metropolitan waterfront plan in December 1967, as discussed in the previous chapter. Among other things, that plan recognised that endikements should be constructed around the perimeter of areas to be filled with fly ash in order to minimize contact with the lake water and to repel wave action during storms.⁹³

In October 1967, some months after the completion of testing, the THC Board approved disposal

⁸⁹ Letter from Jones, THC to J.W.H. Kerr, Area Manager, Lakefront Operating Area, Ontario Hydro, 9 November 1966, THCA RG 3/3 box 351 folder 16.

⁹⁰ Letter from W.A. Steggle, Supervisor, Water Quality Surveys Branch, Division of Sanitary Engineering, OWRC to Jones, THC, 19 April 1967, THCA RG 3/3 box 238 folder 23.

⁹¹ Ontario Hydro Research Division Report 67-317-K, 13 June 1967.

⁹² THC memorandum from Jones to Griffith, 6 October 1967, THCA RG 3/3 box 238 folder 23.

⁹³ Proctor *et al* (1967), p. 23.

of fly ash from the Hearn station at the outer harbour headland.⁹⁴ Staff had estimated that approximately 100,000 cubic yards of fly ash from the Hearn station would be available for disposal at the outer harbour each year, at a suggested dumping fee of 30 cents per cubic yard to pay for additional equipment and handling costs. Other fill material was accepted without charge at the time.

The hauling of ash from the Hearn station to the headland commenced in December 1967 under a two-year agreement. By the middle of the following December, Ontario Hydro had paid the THC slightly more than \$85,000 to accept about 283,000 cubic yards of fly ash at the outer harbour.⁹⁵ Eighteen months later the totals stood at \$201,000 for 670,000 cubic yards of fly ash.⁹⁶ Although it appears that the THC anticipated some net income from fly ash,⁹⁷ the surplus would not have been great. Annual operating costs for the headland exceeded \$100,000 in 1964, when no special measures were required to protect the clean fill then being received;⁹⁸ costs would have increased substantially with the introduction of additional equipment and personnel to mix the coal ash with clean fill.

The volume figures cited above may be underestimates, as Ontario Hydro records indicate that 310,000 cubic yards, 256,000 cubic yards and 228,000 cubic yards of fly ash were accepted in 1967, 1968 and 1969, respectively.⁹⁹ Bottom ash received in each of those years contributed

⁹⁴ THC Board minute no. 24695, 17 October 1967, THCA RG 3/3 box 238 folder 23.

⁹⁵ THC staff report from Griffith to the Board, 27 December 1968, THCA RG 3/3 box 166 folder 1.

⁹⁶ THC memorandum from L. Price, Executive Assistant, Engineering Department to Griffith, 4 June 1970, THCA RG 3/3 box 352 folder 1.

⁹⁷ THC memorandum from Jones to Griffith, 6 October 1967, THCA RG 3/3 box 238 folder 23.

⁹⁸ THC report, "Disposal Area Data", THC Board minute no. 24100, 7 April 1966, THCA RG 3/3 box 260 folder 4.

⁹⁹ Garcia-Lee (1990a).

additional figures of 26,000 cubic yards, 41,000 cubic yards and 41,000 cubic yards, respectively.¹⁰⁰ While the proportion of fly ash in fill had ranged between 2 percent and 25 percent of total volume during the test period in 1967, proportions in practice ranged between one in five and one in six during 1968, 1969 and 1970. Total volumes of fill material received during those years were 1.6 million cubic yards, 1.4 million cubic yards and 1.3 million cubic yards, respectively.¹⁰¹

The acceptance of fly ash as fill material at the outer harbour headland was consistent with the philosophy of the 1967 metropolitan waterfront plan.¹⁰² As mentioned in the previous chapter, the waterfront plan proposed that the considerable amount of new land planned for the central sector be created using clean fill trucked from construction projects in the city, fly ash from the Hearn station, and sand dredged from the lakebed.¹⁰³ According to the THC's Bold Concept report of the same period, 1,000,000 cubic yards of trucked fill and 150,000 cubic yards of dredged material were being dumped at the headland each year.¹⁰⁴ The Bold Concept report did not mention coal ash at all.

About 1.6 million cubic yards of fill material were received at the headland in 1968, as noted above. Most came by truck, primarily from within a radius of six miles.¹⁰⁵ A brisk filling pace was maintained over the next few years, despite the fact that large quantities of clean fill were diverted to the construction of the land base for Ontario Place (a total of 640,000 truckloads between 1969 and 1971¹⁰⁶) and waterfront parks in Etobicoke, Scarborough and at the east bank

¹⁰⁰ *Ibid.*

¹⁰¹ Richardson (1980), p. 16.

¹⁰² Proctor *et al* (1967).

¹⁰³ Proctor *et al* (1967), p. 33.

¹⁰⁴ Jones (1968), pp. 33, 34.

¹⁰⁵ Toronto Harbour Commissioners (1968).

¹⁰⁶ THC *Annual Report* 1970, p. 7, THCA RG 1/2 box 3 folder 17; and THC *Annual Report* 1971, p. 5 THCA RG 1/2 box 3 folder 18.

of Coatsworth Cut.¹⁰⁷ Coal ash, too, continued to be taken to the outer harbour headland in large quantities; having proved profitable to both parties and satisfactory to the OWRC,¹⁰⁸ the fly-ash agreement between the THC and Ontario Hydro was renewed in late 1969 for a further two years.¹⁰⁹ There is no evidence that fly ash was diverted to other projects along with clean fill.

By March 1972, more than nine million cubic yards of clean fill had been used in the creation of the narrow portion of the headland, plus 4.5 million cubic yards for the broader base at the foot of Leslie Street.¹¹⁰ Completion of the headland and hook was expected to require a further 2.3 million cubic yards of fill material, and construction of a newly announced park, eventually named Aquatic Park, was expected to require the placement of an additional 12.5 million cubic yards of fill material,¹¹¹ most of it dredged material. Five million cubic yards of material dredged from the Eastern Channel were placed at the headland in 1973, and 3.5 million cubic yards in 1974.¹¹²

Dredging of the Keating Channel and the inner harbour and its approaches for purposes of both maintenance and improvement had been undertaken by the THC for decades, but it is unlikely that a large proportion of the dredged material was used in land creation before 1973. As discussed below, it was not until the 1970s that disposal of dredged material in the open lake was restricted, so in many cases it would have been easier for dredging barges to discharge the material in the lake than to manoeuvre along the shore to land-creation sites. In fact, land creation using dredged

¹⁰⁷ THC *Annual Report* 1972, p. 7, THCA RG 1/2 box 3 folder 19; and THC *Annual Report* 1973, p. 7, THCA RG 1/2 box 3 folder 20.

¹⁰⁸ THC memorandum from Jones to Griffith, 8 October 1969, THCA RG 3/3 box 166 folder 2.

¹⁰⁹ Letter from J.L. Cooke, Purchasing Agent, Fuels and General Products, Ontario Hydro to Jones, THC, 24 November 1969, THCA RG 3/3 box 166 folder 2.

¹¹⁰ Richardson (1980), p. 16, from THC drawings.

¹¹¹ "Headland and Aquatic Park Facts", THC press release [1973], THCA RG 13/1 box 1 folder 4.

¹¹² Richardson (1980), p. 16, from THC drawings.

material had been determined by the THC to be more than twice as expensive as using trucked clean fill.¹¹³

Fly ash continued to be disposed of at the outer harbour headland until 1974, although in greatly reduced volumes—just 17,000 cubic yards¹¹⁴ of a total of 700,000 cubic yards¹¹⁵ of fill material trucked to the headland in that final year. The great decline in the amount of fly ash received was principally a result of the changeover at the Hearn station from the year-round burning of coal to the burning of natural gas, which had taken place between September 1971 and March 1972.¹¹⁶ Whereas 1.4 million tonnes of coal had been used at the station in 1970, 900,000 tonnes were used in 1971, 300,000 tonnes in 1972 and 200,000 tonnes in 1973.¹¹⁷ Coal continued to be used as a supplementary fuel during the cold winter months when demand was especially heavy; the Hearn station used 190,000 tonnes of coal during its last full year of operation, 1982.¹¹⁸

Fly ash produced after 1974 was taken to disposal sites inland. At the end of 1974, the THC refused a request from Ontario Hydro to accept about 20,000 cubic yards of fly ash over the winter, on the grounds that the ash could not be placed on the headland in such a way that provincial water quality standards would be met.¹¹⁹ The THC had been warned by the Ministry of the Environment, which had succeeded the OWRC, that the placement of 'sporadic' loads of fly

¹¹³ Toronto Harbour Commissioners (1972), p. 38.

¹¹⁴ THC memorandum from Jones to Griffith, 5 September 1975, THCA RG 3/3 box 357 folder 11.

¹¹⁵ Richardson (1980).

¹¹⁶ Garcia-Lee (1990b).

¹¹⁷ *Ibid.*

¹¹⁸ *Ibid.*

¹¹⁹ Letter from Fricbergs, THC to A.J. Crist, Waste Management Engineer, Ontario Hydro, 4 December 1974, THCA RG 3/3 box 352 folder 3.

ash at the water's edge was not acceptable.¹²⁰ It is likely that the warning reflected the impracticality of maintaining space and equipment to mix the small volumes of ash that were being received with clean fill, and need not be interpreted as a departure from the Ministry's previous tacit approval of the disposal of fly ash at the headland. It would not have been economical for the THC to have constructed endikements or taken other alternative protective measures for the relatively small amount that was still in need of disposal. The only subsequent THC correspondence regarding the disposal of coal ash relates to a request from Ontario Hydro in 1979 that the THC accept bottom ash from the Hearn station as fill material at the headland. Although THC staff reacted favourably to the request,¹²¹ the Ministry of the Environment was not supportive and the idea was dropped.¹²²

Land-creation operations at the headland did not end once the land base for Aquatic Park (as originally conceived) was in place. In 1975, the THC began installation of special shore-protection structures and armouring to protect the headland from the destructive power of strong waves from the southeast during storms.¹²³ This required further large quantities of both earth for the core of the structures and rubble for armouring over several years. A still greater demand for fill material at the headland followed the decision to construct endiked basins for the disposal of contaminated sediments dredged from the inner harbour and the Keating Channel.¹²⁴

The first basin was completed in early 1975, and was filled to capacity by the end of the year.¹²⁵ Since that time, a large endikement arm has been extended south from a point along the original

¹²⁰ Letter from S.E. Salbach, Supervisor of Water Quality Surveys, Water Quality Branch, Ministry of the Environment to the attention of Jones, THC, 21 January 1974, THCA RG 3/3 box 261 folder 7.

¹²¹ THC memorandum from Jones to K.J. Gilbert, Director of Projects and Design, 10 August 1979, THCA RG 3/3 box 389 folder 7.

¹²² Lammers (1991).

¹²³ THC memorandum from Jones to Griffith, 14 March 1977, THCA RG 3/3 box 389 folder 3.

¹²⁴ Toronto Harbour Commissioners (1979), p. 3-1.

¹²⁵ THC memorandum from Jones to Griffith, 14 March 1977, THCA RG 3/3 box 389 folder 3.

spine of the headland to enclose larger basins with sufficient capacity to accommodate dredged material for several decades. Although they are not expected to be filled, covered and landscaped for at least 20 years, the endikement arm and basins are now considered to be part of an expanded Aquatic Park, which has been renamed Tommy Thompson Park, as shown on Map 6. Additional expansion using excavated material trucked to the site has continued since the mid-1970s, with the exception of a short hiatus in 1977 and 1978.

In 1977, the THC placed a moratorium on the acceptance of all fill material at the outer harbour, with the exception of rubble needed for shoreline protection.¹²⁶ The moratorium was in response to concern regarding THC fill-disposal practices, which had extended beyond the quality of dredged material to include the use of contaminated excavated material. The THC had already stopped accepting waste materials other than 'clean' fill, but it was recognised that a considerable proportion of even that material came from sites where the soil had been polluted through decades of industrial and other urban use.¹²⁷

The moratorium was lifted in early 1979 after strong lobbying efforts by contractors and builders. However, rudimentary controls were imposed in an attempt to reduce the amount of contaminated material arriving at the headland, and a dumping fee of \$5 per truckload was charged for the first time.¹²⁸ In response to findings that large quantities of contaminated excavated material have continued to be directed to the outer harbour headland for disposal,¹²⁹ the THC has since implemented increasingly strict controls over the quality of fill material accepted at the outer harbour. Most recently, in 1989, the THC Board decided that no contaminated or untested material would be accepted at the headland or any other land-creation project that it might undertake. Not surprisingly, contractors and haulers objected strenuously. The outer harbour headland has clearly retained its value as a waste-disposal site, for excavation and demolition material at least.

¹²⁶ Toronto Construction Association (1978), p. 2.

¹²⁷ Wallace *et al* (1976), p. 25.

¹²⁸ Toronto Harbour Commissioners (1979).

¹²⁹ See Environment Canada *et al* (1982), Sarazin (1986), Trow (1987), Environmental Applications Group (1988).

CONCLUSIONS

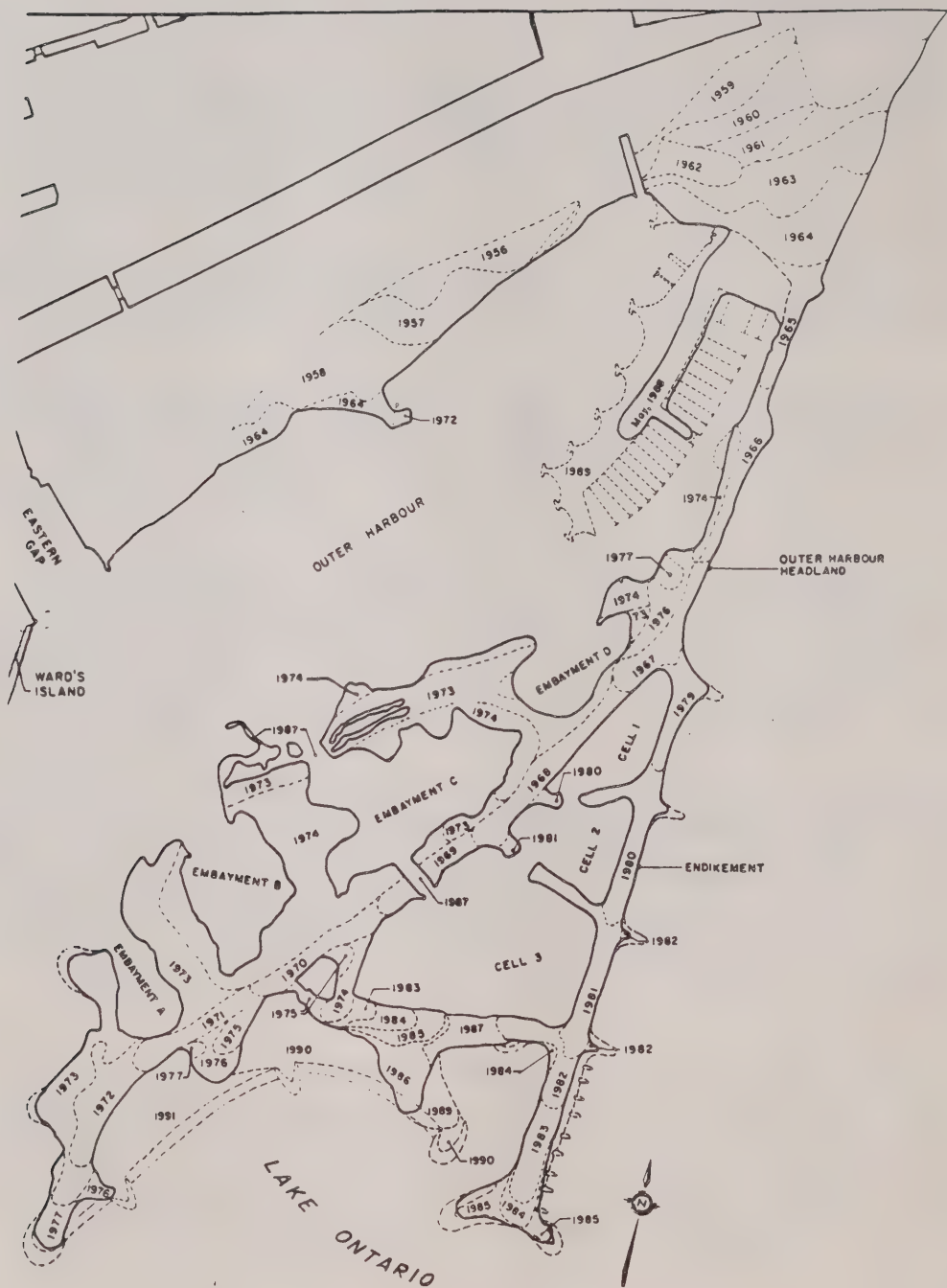
The fundamental finding of this research is that large quantities of coal ash from the R.L. Hearn thermal generating station were disposed of at the outer harbour, initially at the southern edge of the Hearn site and then at the outer harbour headland. The amount of coal ash received at land-creation operations at the outer harbour was significant both in absolute terms and relative to the total volume of fill material received. Most of the coal ash was received at the outer harbour during two distinct phases that correspond to the appearance and growth of significant interests on the part of one or the other of the two principal agencies involved—the THC and Ontario Hydro.

The first period was from 1953 to 1956, when the THC wished to complete the land base for the Hearn site in order to expedite the sale of the site to Ontario Hydro. Because most clean fill received by the THC in the early 1950s was directed to land-creation projects elsewhere along the waterfront, 1955 was the first year of the period of study during which appreciable quantities of clean fill were trucked to the area that came to be the outer harbour. This means that most of the several hundred thousand cubic yards of fill material used to create land at the outer harbour between 1951 and 1955 was apparently coal ash from the Hearn generating station (300,000 of 500,000 cubic yards from 1953 to 1955). A recently reported "heavy yellow and brown sheen" on the surface of the water of the outer harbour has been interpreted as evidence of this practice.¹³⁰

Large quantities of coal ash continued to be directed to the outer harbour throughout the late 1950s. However, coal ash comprised a much smaller proportion of the total once clean fill was no longer diverted to land-creation projects elsewhere along the waterfront. Although it appears that some coal ash continued to be accepted by the THC for disposal at the foot of Leslie Street in the early 1960s, the fact that Ontario Hydro resorted to the practice of flushing fly ash into the Circulating Channel indicates that firm ash-disposal arrangements did not exist throughout this period.

The second period during which very large quantities of coal ash were accepted at the outer harbour began in late 1967 with the finalisation of a fly-ash disposal agreement between Ontario Hydro and the THC. This agreement relieved Ontario Hydro from the predicament of having no disposal site available within what it considered to be an economical distance of the Hearn station. During the first three full years of the agreement, one fifth of the total volume of fill material

¹³⁰ CH2M Hill (1990), p. 8.



MAP 6: Headland Endikement Project

Source: Metropolitan Toronto and Region
Conservation Authority (1989).

received at the outer harbour headland (800,000 of 4.2 million cubic yards) was fly ash, and bottom ash contributed an additional 100,000 cubic yards. However, the importance of fly ash as a fill material at the outer harbour declined in each of the following four years. In 1971, less than 10 percent of the fill material received at the outer harbour headland was fly ash (90,000 of 1.3 million cubic yards¹³¹). By 1974, the last year in which fly ash from the Hearn station was accepted by the THC, the proportion was less than 3 percent of the total volume of fill material trucked to the headland.

The quantity of coal ash, particularly fly ash, placed at the outer harbour is cause for concern on environmental grounds. Although results of systematic studies of the environmental impacts of the disposal of fly ash at the outer harbour do not appear to be available, recent studies of soils in the area have listed the many toxic contaminants that are generally associated with fly ash, and have noted some of the problems that have resulted from disposal practices of the past.¹³² It is clear that the agencies involved in the practice were sufficiently aware of the potential for unwelcome consequences that endikements were recommended. Nevertheless, coal ash continued to be accepted and placed at the water's edge.

The first and most obvious conclusion that can be drawn from these findings is that the outer harbour was a very important dumping ground for coal ash, and, therefore, for undesirable waste material in general. The importance of land creation in Toronto as a means of disposal of coal ash and other undesirable waste materials has escaped systematic attention up to now. This is despite the scale and potential environmental impacts of the disposal of coal ash, and the fact that the outer harbour headland has long been recognised as a waste-disposal facility for so-called clean fill. It has already been established that the main reason for land creation along Toronto's waterfront has been that it is quicker and cheaper for the development industry to take its waste material (clean fill) to the waterfront than to alternative sites inland.¹³³ The same considerations regarding hauling costs and convenience apply equally to public and private utilities that undertake projects involving

¹³¹ Total volume figure from Richardson (1980); fly-ash volume calculated by the author on the basis of figures in a THC memorandum from Jones to Griffith, 5 September 1975, THCA RG 3/3 box 357 folder 12, and coal-consumption figures from Garcia-Lee (1990a).

¹³² CH2M Hill (1990); and M.M. Dillon (1990).

¹³³ Metropolitan Toronto (1984).

excavation,¹³⁴ and to generators of undesirable waste materials. This conclusion is consistent with practices in other cities around the world where the disposal of waste materials, both clean and undesirable, has been a principal purpose for land-creation schemes.

A second conclusion is that institutional arrangements for many years sanctioned the use of Lake Ontario as an important disposal site for very large quantities of potentially harmful material. That coal ash and a variety of other obviously undesirable waste materials were accepted at all can be viewed as evidence of this situation. Presumably, the utility of the outer harbour headland to important public agencies and to private interests were allowed to outweigh those concerns that did exist. As has been recognised in a recent study of waterfront development in Toronto, elaborate public policy and planning processes to determine 'best use' of waterfront lands have influenced redevelopment only occasionally in recent decades.¹³⁵ Most of the time, narrower interests seem to prevail.

The motive of the generator of the coal ash, Ontario Hydro, in sending the material to the outer harbour can be identified with certainty. Ontario Hydro clearly derived tremendous financial benefit from the availability of inexpensive and conveniently located waterfront disposal sites for its waste, just as the Toronto Transit Commission and private developers have derived benefit from the existence of convenient disposal sites at the headland for their excavated material. It was sensible business practice for Ontario Hydro to have repeatedly approached the THC for assistance in overcoming difficulties in finding disposal sites relatively close to the Hearn station.

Identifying the motive of the THC in accepting large volumes of coal ash is more difficult. It was certainly in the interest of the THC during the 1950s to hasten completion of the land base of the Hearn site by allowing Ontario Hydro to place coal ash there. The THC appears to have had much less interest in accepting fly ash once the site was completed, although it supported Ontario Hydro's experiments into the use of fly ash as fill material. When the THC agreed, once again, to accept large quantities of fly ash at the end of 1967, it appears to have been primarily to relieve the difficulty that Ontario Hydro was then experiencing in disposing of fly ash from the Hearn station. While placing fly ash at the outer harbour headland was certainly preferable to flushing it directly into the Circulating Channel, as Ontario Hydro had been doing, other options existed as well. It is

¹³⁴ Environmental Applications Group (1988), p. 198.

¹³⁵ Desfor *et al* (1989), p. 487.

likely that economic arguments regarding the increased cost of hauling to alternative disposal sites inland, and the resulting increased cost of electrical power, prevailed over any practical or environmental arguments that may have been raised.

The THC does not appear to have derived significant benefit by accepting fly ash for disposal at the outer harbour headland. Construction of the headland would doubtless have gone ahead without significant alteration if fly ash had not been accepted. Furthermore, the sums of money paid by Ontario Hydro to the THC for the acceptance of fly ash after 1967, while appreciable, appear to have been little more than would offset the additional cost of handling and mixing coal ash with clean fill and of upgrading infrastructure on the headland to facilitate disposal operations. Lacking a strong interest in accepting fly ash, the THC, one supposes, must have been convinced that there was no particular cost involved either. While the possibility has not been explored in this paper, perhaps professional ties among the staffs of the THC, Ontario Hydro and the OWRC worked in favour of cooperation between the agencies. All approved of the 1967 agreement to accept fly ash at the headland, although they would certainly have recognised that disposal options existed, and that fly ash could have been directed to other sites inland.

The THC, lacking the necessary scientific expertise, relied on regulatory agencies to determine the environmental acceptability of fly ash and other potential fill materials. While a number of objections to the practice of land creation have been raised, the most basic issue is the lack of knowledge regarding long-term environmental effects.¹³⁶ Among the long-term effects are those related to the quality of fill material used. A significant proportion of so-called 'clean' fill is actually earth from urban areas that has been contaminated by toxic substances that have harmful effects when released into water. Subsurface soil quality in areas of the outer harbour headland that were created using trucked clean fill have been found to be considerably worse than that in areas created using dredged material.¹³⁷ Concern regarding the quality of trucked fill is especially valid when the fill material includes ash from the burning of coal. Coal ash is liable to contain a wide variety of toxic heavy metals and chemicals¹³⁸ that will be released into the surrounding surface water either directly or via groundwater movement through soil over a period of years.

¹³⁶ Thomas (1972).

¹³⁷ Trow (1987).

¹³⁸ See CH2M Hill (1990), p. 9.

Even though clean fill is certainly a waste by-product of excavation or demolition activities, it can be argued that such material should also be seen as a building material that can be put to constructive use in the creation of land for a variety of urban uses. A similar case cannot be made for material such as coal ash. The outer harbour headland can therefore be said to have been purely a waste-disposal facility to the extent that coal ash and other undesirable wastes were deposited there.

While environmental controls over disposal at the outer harbour have been strengthened over the years, the OWRC and its successor agency, the Ministry of the Environment, were not always aggressive in protecting the Toronto waterfront from pollution by contaminated fill material. The OWRC gave specific approval for the disposal of incinerator ash and fly ash at the waterfront on a number of occasions from the late 1950s to the early 1970s, despite a recognition that the practice could have significant undesirable consequences. Even the eventual cessation of fly-ash disposal at the headland after 1974 was due to the expense involved, rather than to regulatory vigilance. While the actions of agencies in the past should not be judged by the much stricter environmental standards of today, it is clear that the agencies involved in the disposal of coal ash at the outer harbour, including the OWRC, had become aware of at least some of the concerns regarding the placement of coal ash at the water's edge long before the practice was ended.

Current events in the Toronto area provide an interesting context for evaluating the long-term significance of both the physical and the institutional aspects of the disposal practices of past decades. If the dormant Hearn generating station is reactivated, as is being contemplated by Ontario Hydro,¹³⁹ it is likely that consideration will be given to incorporating the small amount of fly ash that would be produced there into any further land-creation operations at the outer harbour or elsewhere in Toronto. A similar situation regarding the place of coal ash in municipal land-creation schemes exists in Mississauga, immediately to the west of Metropolitan Toronto. In 1990, the City of Mississauga released a draft waterfront plan that presents land creation as "a valid component of public waterfront development".¹⁴⁰ Among other things, the ambitious draft plan calls for the creation of land for new parks at several locations along the waterfront, and the construction of a string of small islands to enclose an existing bay. While the draft plan notes that

¹³⁹ Ontario Hydro (1989).

¹⁴⁰ City of Mississauga (1990a), p. 98.

sources of acceptable fill material will need to be determined,¹⁴¹ there have already been discussions regarding the use of fly ash from Ontario Hydro in implementing the plan. Ontario Hydro now stockpiles fly ash at a number of its sites, particularly the generating station at Nanticoke, and disposal of the ash at the waterfront would free up considerable space for other purposes.¹⁴²

Ontario Hydro is also currently seeking "expression of interest" from owners of licensed landfill sites who would be willing to accept up to 2 million cubic yards of coal ash (up to 300,000 cubic yards per year) from the Lakeview station between the years 1994 and 2006.¹⁴³ All of the fly ash from the station is now trucked for use as a filler in the making of cement for road-making and other projects.¹⁴⁴ However, Ontario Hydro is concerned that the arrangement will not be continued in the long term, and is therefore investigating other options. Disposal at landfill sites inland is just one of a number of possibilities; land creation is no doubt another, although it should be acknowledged that Ontario Hydro would not consider placing the ash either directly into the water or in an enclosed basin. It is instead pursuing options that would entail the binding of the ash with cement before placement in the water.¹⁴⁵

The significance of the options available may go far beyond the Hearn and Lakeview stations, as there are many other generating stations producing coal ash that must be disposed of somewhere. It has been estimated that each year 1 million tonnes of coal ash are produced in Ontario,¹⁴⁶ and 3.5 million tonnes in Canada as a whole.¹⁴⁷ It is likely that practices and institutional relationships similar to those outlined in this paper can be found to apply at ash-disposal sites elsewhere.

¹⁴¹ City of Mississauga (1990b).

¹⁴² Flynn (1991).

¹⁴³ *The Toronto Star*, 11 March 1991.

¹⁴⁴ Barnes (1991).

¹⁴⁵ Flynn (1991).

¹⁴⁶ Kelleher *et al* (1987), p. 5.

¹⁴⁷ Wilson and Burns (1982), p. 1.

Generating stations must be sited near secure sources of cooling water, ideally large lakes. As a result, it is likely that economic considerations will continue to encourage the disposal of coal ash at the water's edge. The opportunity to dispose of such undesirable waste in this way will be used to justify further land creation, particularly in urban areas where alternative disposal sites are unlikely to be available nearby. Here, as elsewhere, urban waste-disposal needs will be used to justify land-creation projects that might not be undertaken otherwise.

LIST OF SOURCES

Primary Sources

Most of the information presented in the second chapter comes from primary sources, principally those held by the archives of the Toronto Harbour Commissioners (THCA in footnotes). Ontario Hydro files, from both corporate archives (OHA) and the R.L. Hearn Generating Station, provided considerable additional material, and the files of the Metropolitan Toronto Works Department were of some assistance as well.

Secondary Sources

Bird, J. (1968), *Seaport Gateways of Australia* (London: Oxford University Press).

Bristow, R. (1984), *Land-use Planning in Hong Kong* (Oxford: Oxford University Press).

CH2M Hill Engineering Limited (1990), *Environmental Investigation Study, Cherry Beach Waterfront Park, Stage 1: Literature and Archival Search* (Toronto: Toronto Harbour Commissioners).

Chiu, T.N. (1973), *The Port of Hong Kong: a Survey of its Development* (Hong Kong: Hong Kong University Press).

City of New York - Borough President of Richmond - City Construction Co-ordinator - Department of Sanitation and Department of Parks (1951), *Fresh Kills Land-Fill* (New York: Board of Estimate).

Dames and Moore (1978), *An Assessment of the Effect on the Environment of the Proposed Stage II Land Fill Scheme at Kooragang Island, Newcastle, New South Wales* (Sydney: New South Wales Department of Public Works).

Desfor, G. (1988), "Planning Urban Waterfront Industrial Districts: Toronto's Ashbridge's Bay, 1889-1910", pp. 77-91 in *Urban History Review* XVII 2.

Desfor, G., M. Goldrick and R. Merrens (1989), "A Political Economy of the Water-frontier: Planning and Development in Toronto", pp. 487-501 in *Geoforum* 20 4.

Environment Canada - Environment Protection Service and Ontario Ministry of the Environment - Central Region (1982), *Lakefill Quality Study, Leslie Street Spit, City of Toronto* (Toronto: Environment Canada).

Environment and Health Work Group (1988), *Environment and Health: Issues on the Toronto Waterfront* (Toronto: Royal Commission on the Future of the Toronto Waterfront)

Environmental Applications Group (1988), *An Evaluation of Lakefilling Activity in Ontario, Final Report* (Toronto: Ontario Ministry of the Environment).

Fricbergs, K.S. (1965), "Beach Stabilization in the Toronto Area". Unpublished thesis for registration in the Association of Professional Engineers of Ontario, Toronto.

- Fricbergs, K.S. (1985), "Shorezone Development of Rubble Mole in Toronto", in *Proceedings*, Canadian Coastal Conference.
- Fricbergs, K.S. (1989), "Recent Changes to Toronto's Shoreline". Unpublished paper presented at Toronto's Changing Waterfront: Perspectives from the Past symposium, Toronto.
- Garcia-Lee, V., Materials and Waste Management Section, Environmental Protection Department, Central Production Services Division, Ontario Hydro (1990a), letter to the author, June.
- Garcia-Lee, V., Materials and Waste Management Section, Environmental Protection Department, Central Production Services Division, Ontario Hydro (1990b), personal communication with the author, November.
- Gemmil, A. (1978), *Toronto's Outer Harbour Eastern Headland: the changing role of a transportation facility* (Toronto: University of Toronto/York University Joint Program in Transportation). Research Report No. 55.
- Gibb, Albery Pullerits and Dickson (1969), *Future Port Requirements, Western Lake Ontario* (Ottawa: Department of Public Works).
- Goudie, A. (1986), *The Human Impact on the Environment* (Cambridge, Mass.: MIT Press).
- Gray, A.J. (1977), "Reclaimed Land", pp. 253-263 in R.S.K. Barnes, *The Coastline* (London: John Wiley and Sons).
- Greenberg, K. and G. Sicheri (1990), *Toronto's Moveable Shoreline* (Toronto: Canadian Waterfront Resource Centre). Working Paper No. 5.
- Hudson, B.J. (1979), "Coastal Land Reclamation with Special Reference to Hong Kong", pp. 3-16 in *Reclamation Review* 2.
- Intra Kenting (1990), *Final Report on the Phase 2 Soils and Groundwater Study of the East Bayfront and Port Industrial Area of Toronto* (Toronto: Royal Commission on the Future of the Toronto Waterfront). Technical Report No. 11.
- Jones, J.H. (1968), *A Conceptual Plan for the Development of the City of Toronto Waterfront* (Toronto: Toronto Harbour Commissioners).
- Keating, E.H. (1892), "Ashbridge's Bay Reclamation", in *City Engineer's Annual Report for 1892* (Toronto: City Engineer's Office).
- Kelleher, M., G. Zukovs, S. Dedhar and B. Whiffin (1987), "Development of Guidelines for the Utilization of Industrial Wastes in Backfill and Construction Applications in Ontario", in *Proceedings*, Technology Transfer Conference 1987, Toronto.
- Krieger, A. and L.J. Green (1985), *Past Futures: Two Centuries of Imagining Boston* (Cambridge, Mass.: Harvard University Graduate School of Design).
- Lammers, W., Central Region, Ontario Ministry of the Environment (1991), personal communication with the author, February.

Lumb, P. (1976), "Land Reclamation in Hong Kong", pp. 299-314 in *Proceedings, Residential Workshop on Materials and Methods for Low Cost Road, Rail and Reclamation Works*, Leura, Australia.

M.M. Dillon Limited (1990), *Port Business Park Soil Quality Study, Phase 1: Soil and Ground Water Investigation* (Toronto: Toronto Harbour Commissioners).

Merrens, R. (1988), "Port Authorities as Urban Land Developers: The Case of the Toronto Harbour Commissioners and Their Outer Harbour Project, 1912-68", pp. 92-105 in *Urban History Review* XVII 2.

Metropolitan Toronto - Commissioner of Planning and Commissioner of Works (1984), "Clean Fill Disposal Study". Report to the Municipality of Metropolitan Toronto Economic Development Committee, 23 May.

Metropolitan Toronto - Department of Works - Water Pollution Control Division (1963), *Small Boats Harbour in the Vicinity of Ashbridges Bay*.

Metropolitan Toronto and Region Conservation Authority (1989), *Tommy Thompson Park: Master Plan and Environmental Assessment*.

Moir, M. (1988), "Ashbridges Bay ... from marsh lands to port", pp. 6-9 in *Port of Toronto News* 35 4.

Munson, W.E. (1990), *Soil Contamination and Port Redevelopment in Toronto* (Toronto: Canadian Waterfront Resource Centre). Working Paper No. 3.

O'Mara, J. (1976), *Shaping Urban Waterfronts: The Role of Toronto's Harbour Commissioners, 1911-1960* (Toronto: York University Department of Geography). Discussion Paper No. 13.

Proctor, Redfern, Bousfield and Bacon (1963), *The Appraisal of the Waterfront Plan for the Metropolitan Area* (Toronto: Metropolitan Toronto Department of Works).

Proctor, Redfern, Bousfield and Bacon (1964), *Land Fill Study for Waterfront Development* (Toronto: Metropolitan Waterfront Technical Committee). Reprinted as Appendix 'C' to Proctor *et al* (1967).

Proctor, Redfern, Bousfield and Bacon (1967), *The Waterfront Plan for the Metropolitan Toronto Planning Area* (Toronto: Metropolitan Toronto Planning Board and the Metropolitan Council).

Progressive Architecture (1967), "Filling the Waters", pp. 166-174 in *Progressive Architecture* April.

Richardson, W.S. (1980), *Toronto Harbour Study, 1976 to 1979: Volume 1, Background Material* (Toronto: Ontario Ministry of the Environment).

San Francisco - Bay Conservation and Development Commission (1969), *San Francisco Bay Plan Supplement* (San Francisco: San Francisco Bay Conservation and Development Commission).

Sarazin, L. (1986), *Environment Canada Leslie Street Spit Truckfill Survey* (Toronto: Environment Canada).

Scardino, A. (1987), "When More Manhattan Needed, New York Just Creates It", in the *New York Times*, 22 March.

Shindoh, M. and Y. Suzuki (1988), "Case Study on the Solid Waste Management System in Kitakyushu", in *Proceedings*, International Expert Group Seminar on Improving Solid Waste Management in the Context of Metropolitan Development and Management in Asian Countries, Beijing.

Thomas, E.W. (1972), "Town Planning and Harbours", in *Town Planning Quarterly* 27.

Toronto Construction Association (1978), "Proposal to re-open the Eastern Headland in the Toronto harbour to a controlled landfill program, the purpose of which is to provide for necessary armament and protection and to secure a long-term commitment from government to a continuing landfill program on the Metropolitan Toronto waterfront". Brief considered by Municipality of Metropolitan Toronto Council, 16 January 1979.

Toronto Harbour Commissioners (1912), *Toronto Waterfront Development, 1912-1920* (Toronto: Toronto Harbour Commissioners).

Toronto Harbour Commissioners (1968), *Port of Toronto News* 15 2.

Toronto Harbour Commissioners - Engineering Department (1972), *The Toronto Island Beach Reclamation and Stabilization: a Feasibility Study* (Toronto: Toronto Harbour Commissioners).

Toronto Harbour Commissioners - Engineering Department (1979), *Dredging and Endikement Project* (Toronto: Toronto Harbour Commissioners).

Trow Hydrology Consultants Limited (1987), *Final Report A: Quality of Fill Deposited at Leslie Street Spit, 1963 to 1986* (Toronto: Ontario Ministry of the Environment).

United States - Army Engineer Waterways Experiment Station (1986), *List of Publications of the US Army Engineer Waterways Experiment Station, Volume 1* (Vicksburg, Miss.: United States Army Engineer Waterways Experiment Station).

Wallace McHarg Roberts and Todd (1976), *Environmental Resources of the Toronto Central Waterfront* (Toronto: Central Waterfront Planning Committee and the City of Toronto Planning Board).

Whitehill, W.M. (1968), *Boston: A Topographical History* (Cambridge, Mass.: Belknap Press).

Wilson, D. (1978). *Planning for a Changing Urban Waterfront* (Toronto: York University Department of Geography). Discussion Paper No. 18.

Wilson, H.S. and J.S. Burns (1982), *Beneficiated Products from Fly Ash: Market Research* (Ottawa: Energy Mines and Resources Canada). Canada Centre for Mineral and Energy Technology Report 82-17E.

Sources of Current Information

The following people and reports provided information regarding current plans and practices.

Barnes, P., Materials and Waste Management Section, Environmental Protection Department, Central Production Services Division, Ontario Hydro (1991), personal communication with the author, March.

City of Mississauga - Planning Department (1990a), *A Draft Plan for the Mississauga Waterfront: Fundamentals*.

City of Mississauga - Planning Department (1990b), *A Draft Plan for the Mississauga Waterfront: Implementation*.

Flynn, J., Central Production Services Division, Ontario Hydro (1991), personal communication with the author, February.

Ontario Hydro (1989), *Demand/Supply Plan Report*.

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